A variationist account of voice onset time (VOT) among bilingual West Indians in Panama

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1. Introduction

The country of Panama provides an ideal situation for analyzing effects of contact on linguistic systems because, in spite of having Spanish as the official and dominant language, certain varieties of English have been present in this region since the 1800s due to immigration from the English-speaking Caribbean islands, thus constituting a situation of intense contact. This study is concerned with contact between Spanish and a particular variety of English known as Panamanian Creole English (PCE). Various researchers have become interested in this contact situation in Panama, focusing mainly on variation and change in PCE and its diglossic relationship with Spanish, particularly in Bastimentos (e.g., Aceto, 1998; Snow, 2000). However, there is a lack of studies that focus on possible bidirectional effects between the two languages. A study of this type would entail analyzing both PCE and Spanish to discover language change and determine its possible source. Therefore, one of the goals of this study is to take into account the whole linguistic repertoire, that is, both PCE and Spanish, when studying contact-induced change in bilingual West Indian speech. The aim is to use variationist methods to analyze the phonological/phonetic system of Spanish-Creole English bilinguals in terms of stop realization to determine whether there is change occurring, and the putative source of this change. Furthermore, I explore specific hypotheses about bilingual phonology/phonetics found in the Speech Learning Model developed by Flege (1995a). More specifically, I seek to answer the following questions: 1) what is the distribution of mean VOT duration among monolinguals and bilinguals living in Panama, and 2) is there evidence of change in the speech of bilinguals, and is said change due to language contact or internal evolution?

In order to analyze change in a contact situation, it is crucial that a conflict site is identified. This is an area where the structures of a language pair do not coincide (Poplack & Meechan, 1998:132), that is, they conflict. Therefore, in this study, I focus on a linguistic property that appears to differ between Spanish and Creole English, voice onset time (VOT), specifically, of the voiceless dental plosive[1]. VOT is an acoustic property defined as the time interval between the release, or occlusion, of a consonant stop and the onset of vocal cord vibration (Lisker & Abramson, 1964:387). This property differs across languages in terms of duration. Particularly in Spanish, VOT duration is no longer than 25 milliseconds (msec.), and in English, no less than 30 msec. (Lisker & Abramson, 1964). Thus, VOT duration provides an area for analyzing potential effects of language contact in the bilingual West Indian speech community in Panama. This is one of few studies to use variationist methods to analyze VOT duration in monolinguals and bilinguals.

The remainder of the paper is organized as follows. Section 2 discusses the use of Spanish and Creole English in Panama. Section 3 explores models that have been developed in the analysis of bilingual speech production, with a special focus on the Speech Learning Model. The comparative variationist enterprise is briefly explained in Section 4. Section 5 provides a detailed discussion on VOT production in monolinguals and bilinguals. Section 6 describes the

[1] Spanish and English differ in place of articulation with regard to this consonant stop. In Spanish, the plosive is dental, and in English, it is alveolar. Place of articulation will not be considered as a factor in the present analysis as no study has reported on its possible effects.

methodology of the analysis. Lastly, the results and conclusions are discussed in Sections 7 and 8.

2. Spanish and Creole English in Panama

Spanish has not only been the national language, but also the official language of Panama since 1941 (Constitution of 1941, Title 1, Article 10)[2]. Most of the population speaks the language as their mother tongue, and according to Alvarado de Ricord (1982:98), it has become part of the national identity of Panama in the face of American imperialism. However, because of the strong presence of the United States, English is considered to be a means of survival (Alvarado de Ricord, 1982:98). The West Indian speech community is the only group in Panama besides American expatriates that speak English as a first language. However, the variety that West Indians refer to as English is an English-based creole that originates from their ancestors who had arrived from various English-speaking Caribbean islands

Panamanian Creole English (CE) can be divided into four different varieties: Bastimentos CE, Isla Colón CE, Colón City CE, and Panama City CE. Bastimentos CE and Isla Colón CE are spoken in the province of Bocas del Toro, specifically on the islands of Bastimentos and Isla Colón. CE speakers arrived in this region during two waves of immigration to the region from the islands of San Andrés and Providence, Jamaica, Corn Island, Nicaragua, and Bluefields, Nicaragua during the 19th and 20th centuries (Guerrón Montero, 2002). Bastimentos CE has received particular attention in creolistics (e.g., Aceto, 1998, 2001; Snow, 2000, 2003) with analyses that focus on topics ranging from variation and change to sociocultural factors that play a role in the development and use of the variety on the island. Isla Colón CE has not received any attention in the field.

Panama City CE and Colón City CE are spoken in the metropolitan areas of Panama, specifically in Panama City and in the City of Colón[3]. CE speakers living in these areas, who are referred to as West Indians or *antillanos*, are descendants of immigrants who arrived in Panama in the mid-1800s during the construction of the Panama Railroad and the first and second phases of the construction of the Panama Canal. These projects triggered three waves of immigration to Panama from islands such as Martinique, Guadeloupe, Jamaica, and Barbados. By 1914, more than 200,000 West Indians had arrived in Panama, making them the largest group of immigrants in a country that had a total population of only 400,000 people (Conniff, 1985). Panama City CE, to my knowledge, has been described in only one published work by Thomas-Brereton (1992), and Colón City CE has not been described in any study.

Although previous researchers have grouped these four English-based creoles under the umbrella of Panamanian Creole English, I distinguish among them due to their degree of "creoleness"[4] and the exposure that the speakers have to Spanish, the latter possibly having an

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[2] A copy of Constitution 1941 can be found at Biblioteca Digital Panameña: http://www.binal.ac.pa/buscar/clconst.htm

[3] Note that the city of Colón refers to the capital of the province of Colón located on the Atlantic end of the Panama Canal, and differs from the main island of Bocas del Toro known as Isla Colón.

[4] Bastimentos CE and Isla Colón CE can be considered more basilect (more creole-like) varieties compared to Colón City CE and Panama City CE, which are considered more mesolect varieties, that is, they approach a more standard version of English. This is due to several sociocultural reasons that are beyond the scope of this paper. See Bickerton (1973), de Rooij, (1994) and Rickford (1987) for discussions on the post-creole continuum and my unpublished dissertation for a more detailed discussion on the creole features found in the four varieties discussed in this paper.

important effect on the production of speech sounds. All creole speakers in Panama are bilingual in Spanish to some extent; however, those that live in Bocas del Toro could be considered less dominant in Spanish or at least more dominant in CE. This is especially true for the Bastimentos CE speakers (cf. Snow, 2000), where CE is the first and dominant language spoken by both younger and older generations. Spanish in Bastimentos is only used in formal settings, such as in school and church, and bilingualism is not common among the older residents. Isla Colón CE speakers may exhibit more use of Spanish, as Isla Colón is the main island of the province and there is more contact with monolingual Spanish speakers. As for Colón City CE speakers in the city of Colón, bilingualism is much more common; however, monolingualism in Creole English is found among older speakers and monolingualism in Spanish, among younger speakers. This is even more so among Panama City CE speakers since Spanish is almost indispensable, as Panama City is the capital of the country and there are less creole speakers in this area. Figure 1 shows how Creole English speakers can be organized on a continuum in terms of Spanish exposure/dominance.

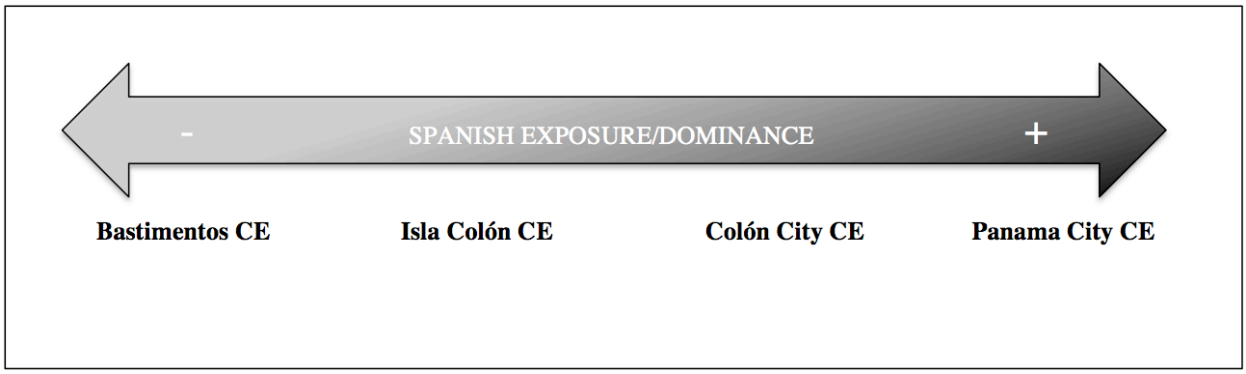

Figure 1. Panamanian Creole English speakers on a Spanish exposure/dominance continuum

This categorization is crucial for the present analysis because in order to examine effects of language contact on phonological/phonetic systems in this bilingual speech community, we must identify pre-contact or surrogate varieties that can serve as baselines to which to compare (see Section 4). In the following section, I review the literature concerned with bilingualism and contact-induced change, particularly in the analysis of speech sounds.

3. Bilingual speech production

Contact outcomes in phonology have been explained through several models that focus on a similarity/dissimilarity dichotomy between the L1 and the L2 (see Lado, 1957; Oller & Ziahosseini, 1970; Major & Kim, 1996; and Wode, 1983); however, one of the most debated models has been the Speech Learning Model (henceforth SLM). This particular model is based on a merger hypothesis presented by Flege (1987) in which he claims that similar sounds are harder to learn because they are identified as being equivalent to a sound in the L1. This hypothesis is based on an equivalence classification that allows speakers to establish sound categories based on phonetic information. If the L2 sound is similar to an L1 sound, it will be classified as the L1 sound, and thus, its production will not be target-like. His study on English-speaking learners of French confirmed this hypothesis. Experienced L2 learners of French produced the French /ü/ more authentically than the French /u/, which has a similar counterpart in English.

In Bohn and Flege (1992)'s study on German speakers learning English, they hypothesized that the amount of L2 experience would not affect the L1 German speakers' production of the similar English vowels /i I ɛ/. However, English language experience would allow them to produce /æ/ authentically since a counterpart does not exist in German. They performed two experiments comparing the production of the English vowels by experienced learners and inexperienced learners who were native speakers of German. The results of the comparison confirmed the hypothesis. The more experienced group did not produce the similar English vowels /i I ɛ/ more native-like than the less experienced group. With regard to /æ/, which does not have a counterpart in German, inexperienced L2 learners produced this new vowel in the same way as the native English speakers. Major (1987) also discovered support for the similarity/dissimilarity hypothesis in Brazilian Portuguese speakers learning English. The study showed that a foreign accent was detected with the similar /ɛ/ but not the dissimilar /æ/.

In the SLM, the age of acquisition plays an important role in how bilinguals produce sounds that are similar in their two languages. Early bilinguals tend to maintain similar sounds separate according to languages since the L2 phone is established independently of the L1, which is not fully developed at an early age. Late bilinguals tend to show convergence in their phonetic system because the equivalence classification blocks the L2 sound category from being established. They seem to overlook important sensory information that distinguishes the L2 from the L1 (Flege, 1987; Flege, 1995a).

Although it has been observed that similarities and dissimilarities between the L1 and the L2 can have an effect on how certain speech sounds are acquired and produced by bilinguals, it appears that there is an assumption that bilinguals differ from their monolingual counterparts solely because they are bilingual, that is, only because of language contact. They fail to take into account that differences between bilingual speech and monolingual speech could be due to internal changes occurring in the languages (cf. Poplack & Levey, 2010:397-398). It is possible that characteristics or changes in bilingual speech that appear to be due to contact are actually a result of internal linguistic processes. Therefore, it is paramount in a study of language contact that the researcher disentangle contact-induced change from internally motivated change in order to make claims that any change evidenced in bilingual speech is indeed due to contact. One way to distinguish between these two types of change is through the comparative variationist method (Poplack & Tagliamonte, 2001), which I discuss in the following section.

4. Comparative Variationist Enterprise

In their discussion on the comparative variationist method in the study of language contact, Poplack and Levey (2010) state that "much evidence brought to bear on contact-induced change – diachronic or synchronic – either fails to demonstrate that change has occurred, and/or if it has, that it is the product of contact and not internal evolution" (Poplack & Levey, 2010:391). Therefore, in order to make a distinction between contact-induced change and internal evolution, they propose a series of comparisons among precursor or surrogate varieties and contact varieties to determine how the variants are used (Poplack & Levey, 2010:394-395).

Once the change is recognized, it must be determined whether it is contact-induced or internally motivated (Poplack &Levey, 2010:397). Poplack and Levey (2010:398) present alternative criteria to Thomason's (2001:62) definition for recognizing contact-induced change: 1) the form must be absent in a pre-contact or non-contact variety, or 2) if present, not conditioned in the same way as in the source language, and 3) the behavior of the form must parallel that of a counterpart feature in the source. These conditions are made visible through

systematic quantitative comparisons, in which a comparative variationist method (Poplack & Tagliamonte, 2001) is employed (Poplack & Levey, 2010:398-401). I further discuss these conditions in the methodology.

Recall that in order to adequately examine potential effects of contact within the comparative variationist enterprise, a conflict site, which is an area where two languages in contact do not match (see Introduction), must be identified. However, in terms of phonetics and phonology, identifying the conflict site could be problematic. In Section 3, I discussed that various models accounting for change in situations of contact between sound systems claim that vulnerability is apparent where the two languages are similar. We must, however, take precaution, as this similarity is only superficial. When looking at the subtle details of the sounds, such as acoustic cues, we notice that the languages do indeed conflict. This is the case when analyzing the voiceless dental plosive in terms of VOT duration. Although both Spanish and English have this sound, they exhibit differences with regard to VOT duration. Therefore, we can consider this acoustic cue to be an ideal candidate for the analysis of sound change among Spanish-English bilinguals. In the ensuing section, I discuss VOT in more detail, highlighting the differences that arise between Spanish and English and also reviewing various factors that have been shown to contribute to its variability.

5. Voice onset time

Lisker and Abramson (1964:387) define voice onset time (VOT) as the duration of the time interval between the release of a stop and the onset of glottal vibration, whether this onset occurs before the release or follows it. When there is presence of glottal buzz during the closure, the stop is considered voiced. If there is absence of glottal buzz during this stage, the stop is categorized as voiceless (Lisker & Abramson, 1964: 384). Both voiced and voiceless stops can be acoustically distinguished through spectrographic or waveform analyses.

One important characteristic in pinpointing voiceless stops in particular is aspiration, which is the turbulent air that flows during the stop release (Docherty, 1992:8). The duration of the aspiration is considered the VOT. Figure 2 is a spectrogram and waveform analysis of the voiceless alveolar plosive (t) in the word team, which has a VOT of 52 msec. In this figure, aspiration is noticeable by the segment of aperiodic waves, and the onset of voicing is observed as periodic waves.

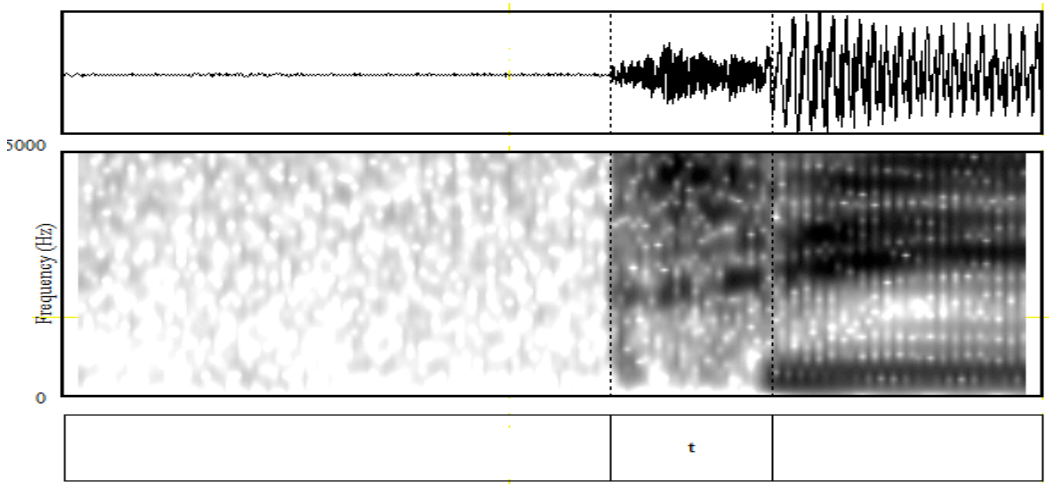

Figure 2. Spectrogram and waveform of a voiceless alveolar plosive.

As previously mentioned, the current study is concerned with the voiceless dental plosive (t), which in English has a mean VOT value of 70 msec. and thus, is categorized as long-lag because voicing follows well after the release of the stop. The voiceless dental plosive in Spanish has a mean VOT value of 9 msec. and therefore is categorized as short-lag because voicing occurs shortly after the release of the stop (Lisker & Abramson, 1964:392-394). Although these mean VOT values have been evidenced in several varieties of Spanish and English, it has been noticed that consonant stops can show a wide range of variability in terms of this acoustic property. Said variability can depend on several linguistic and extralinguistic factors. In Section 5.1, I discuss some of the previous studies that explore the effects of these factors in both Spanish and English.

5.1 Factors contributing to VOT variation

There are several factors that condition VOT values, such as place of articulation, preceding segment, following vowel height, syllable stress, speech rate and age. With regard to place of articulation it has been observed that VOT values become greater as place of articulation moves from anterior to posterior. That is, bilabial stops have shorter VOT durations than dental stops, and dental stops have shorter VOT durations that velar stops (Jacques & Gurlekian, 1992; Morris, McCrea & Herring, 2008; Yavas & Wildermuth, 2006).

Turning to preceding segment, various studies have found that VOT duration becomes shorter when preceded by a fricative or a nasal (Yoshioka, Löfqvist, & Hirose, 1981; Roldan & Soto Barba; but see Munday, 2001). In spite of the fact that Lisker and Abramson (1964) claimed that following vowel height did not have an effect on VOT values, it has been observed in various analyses that VOT duration is longer when followed by high vowels, and shorter when followed by low vowels (Rosner, Lopez Bascuas, Garcia Abea & Fahel, 2001; Port & Rotunno, 1979).

In terms of syllable stress, Castañeda (1986) and Déniz (2005) discovered that when voiceless stops appeared in stressed syllables, their VOT values tended to be shorter in Peninsular Spanish and Canarian Spanish, respectively. Lisker and Abramson (1967) found that in monolingual varieties of English VOT duration was longer in tonic syllables, and shorter in atonic ones. Generally, researchers have hypothesized that a faster rate of speech will usually cause VOT duration to be shorter. This was supported by Schmidt and Flege (1996) and Magliore and Green (1999) for English and Spanish speakers.

Age has been an important factor with regard to VOT duration in bilinguals, particularly, age of acquisition. According to Flege's (1995a) SLM, cross-language phonetic differences are more likely to be discerned as the age of acquisition decreases. Thornburg and Ryalls (1998) found that early learners of English usually contrasted VOT values to a greater degree than later learners of English, thus supporting the SLM. Additionally, early French-English bilinguals are more capable of maintaining a separation of phonetic categories (Caramazza et al., 1973; Macleod & Stoel Gammon, 2009). However, interference was more evident from Canadian French to Canadian English, which Caramazza, Yeni-Komshian, Zurif, and Carbone's (1973) claim was due to these bilinguals learning English at a later age.

5.2 Bilingual VOT Production

The studies analyzing bilingual production of stops have shown that several factors play a role on VOT values and have shed light on how bilinguals mentally separate languages. In the

SLM (see Section 3), Flege (1995a) bases the merged phonetic representation hypothesis on evidence of compromise VOT values, that is, values that fall between the prototypical ranges for each language. This process is referred to as cross-language assimilation, and is said to occur because bilinguals make an equivalence classification of similar sounds from both languages (Flege, 1987; Flege, 1995b:101). Recall that if the L2 is learned at a later age, the development of new or similar L2 phones is blocked because older children and adults do not note the phonetic differences between L1 phones and L2 phones (Flege, 1987:50).

Another type of process that can occur is cross-language dissimilation, in which speakers deflect from a phonetic category in order to maintain a distinction. That is, a Spanish-English bilingual may produce extra-long VOT values in English in order to distinguish from longer VOT values in Spanish. According to Flege (1995b:101), this is more common in bilinguals who acquire the L2 at an earlier age. Since the L1 is not completely developed in younger children, they do not solely depend on the L1 to categorize L2 phones (Flege, 1987). Perceptually, although they coexist in the bilingual mind, these L1 and L2 sound categories move away from each other, thus showing less convergence in their production (Flege, 2007). The present analysis further explores these claims of convergence and divergence in bilinguals using variationist methodology with the assumptions that convergence at the individual level will lead to convergence in a long-term contact situation in the speech community.

I have demonstrated up to now that VOT duration serves as an ideal site for the analysis of potential effects of contact between Spanish and English because these languages treat this variable differently. Also, several factors can affect VOT duration, thus demonstrating its inherent variability, which in turn, requires a variationist methodology in the examination of this acoustic property. This methodology is described in Section 6.

6. Methodology

6.1 Sociolinguistic interviews

The data for the present study were collected by the author through sociolinguistic interviews in order to capture "real language use" (Milroy, 1992:66) or "everyday speech" (Sankoff, 1980:54) of the community. A "friend of a friend" approach was used in seeking participants in order to overcome the observer's paradox (Milroy 1987:59-60). This method allows the researcher to enter the speech community as a common acquaintance so that they are treated as an insider. All of the participants, in one way or another, were found through connections with family members or close friends. This first allowed for friendly interactions with the participant, which in turn made the environment more relaxed in which to conduct the interview.

Several interview modules described by Labov (1966) were adopted, such as the American Language Survey. Also, some questions were based on historical and current events particular to Panama. All interviews lasted at least 1.5 hours, which was necessary not only for capturing phonetic patterns of everyday speech, but also for gaining an appropriate amount of data for a statistical analysis.

The equipment used for the data collection included a Sony Digital Voice Recorder ICD SX750 and a Shure Microphone SM10A, which were selected based on their high quality recordings. This is important in an acoustic analysis because spectrographic programs are sensitive to noise. Besides, since the goal was to capture natural speech in the participants' normal environment, such as their homes or even in a car, the best option was to use a head

mounted microphone. Placement of the microphone in relation to the participants' mouth was also controlled as much as possible.

6.2 Participants

Table 1. Participants

	Pseudonym	Sex	Place of origin
Monolingual Spanish speakers			
	Gloria	F	Tocumen
	Jacinta	F	Pedregal
	Lalo	M	Las Cumbres
	Laura	F	Las Acacias
	Ricardo	M	Panamá Centro
Monolingual Creole English speakers			
	Debby	F	Bastimentos
	Herlin	F	Bastimentos
	Janaira	F	Bastimentos
	Merilyn	F	Bastimentos
	Nadia	F	Bastimentos
Spanish-Creole English bilinguals			
	Alberto	M	Rio Abajo
	Alicia	F	Parque Lefevre
	Dora	F	Juan Diaz
	Rogelio	M	Juan Diaz
	Samuel	M	La Boca

This analysis utilizes data from 15 speakers living in different areas of Panama, who represent four varieties: monolingual Spanish, monolingual CE, bilingual Spanish, and bilingual CE. There are 5 monolingual speakers of Panamanian Spanish from the capital of Panama, who live in areas such as Las Acacias, Las Cumbres, Pedregal, and Tocumen. Additionally, 5 monolingual speakers of Bastimentos CE from the province of Bocas del Toro on the Island of Bastimentos are included. Lastly, there are 5 bilingual speakers of Panamanian Spanish and Panama City CE, who live in areas such as Rio Abajo, Parque Lefevre, La Boca, Tocumen, and Chorrera. As discussed in Section 2 and illustrated in Figure 1, most CE speakers in Panama City are fully bilingual and possibly more dominant in Spanish than in CE. All 5 bilinguals who participated in the present study claimed to have learned CE in the home and Spanish by the age of 5. They use both languages daily with friends and family; therefore, I consider them to be early balanced bilinguals. Although no test was administered to evaluate their level in either language, it was clear in the sociolinguistic interviews that the speakers were fluent in both Spanish and CE. Since the goal of the analysis is to discover possible language change in both languages, the bilingual group constitutes two different datasets or varieties: bilingual Spanish and bilingual CE.

Poplack and Levey (2010) state that monolingual varieties are necessary in the comparative method in order to determine whether or not change is occurring in a language contact situation. However, ideally, these monolinguals should be from a local region so that change is substantiated through the comparison of local norms (Torres Cacoullos & Aaron, 2003). This is slightly problematic for the present analysis because it is difficult to find true monolingual CE speakers in Panama since in certain domains one must be able to communicate in Spanish. Although I categorize the CE speakers of Bastimentos as monolinguals, some of the residents in this area may have some level of Spanish. Therefore, for purposes of this study, I consider them dominant speakers of CE (see Figure 1 in Section 2.2).

6.3 Research Questions

Based on the discussion of the previous literature, I pose two research questions: 1) what is the distribution of mean VOT duration of the voiceless dental /t/ in the speech of Spanish and Creole English monolingual speakers and Spanish-Creole English bilingual speakers and 2) based on the comparisons of factors contributing to VOT duration, is there evidence of change in bilingual speech, and if so, what is the source of the change?

6.4 Hypotheses

Hypothesis 1 is concerned with the overall mean VOT durations in the monolingual and bilingual speakers in this analysis. Based on previous studies that analyzed VOTs in varieties of Spanish and English, I hypothesize for Research Question 1 that monolingual speakers of Spanish will exhibit the shortest mean VOT for the voiceless dental plosive. Also, I expect monolingual speakers of CE to produce the voiceless dental plosive with a longer mean VOT than that of monolingual speakers of Spanish (cf. Lisker & Abramson, 1964). As for bilinguals, I hypothesize that they will exhibit mean VOTs in Spanish that fall between the prototypical values of the monolingual varieties of Spanish and CE. In CE, bilinguals will produce mean VOTs that are longer than the monolingual variety of CE (cf. Caramazza et al., 1973; Flege, 1995a; Thornburg & Ryalls, 1998; Macleod & Stoel Gammon, 2009).

Hypothesis 2 is concerned with the comparisons of the statistical results across the four varieties (Research Question 2). These comparisons provide evidence of language change with regard to the phonetic system of bilinguals. When comparing bilingual Spanish to the monolingual varieties of Spanish and CE, I expect bilinguals to perform more similarly to monolingual speakers of Spanish. When comparing bilingual CE to the monolingual varieties, I expect bilinguals to assimilate CE to Spanish and not to a monolingual-like CE variety. These hypotheses are based on the fact that Spanish is the dominant language of this speech community (see Thomason, 2001). These early balanced bilinguals would be more prone to having more Spanish-like production in both languages, thus giving evidence of language change due to contact. Sections 6.5 – 6.8 explain the procedures carried out in order to test these hypotheses.

6.5 Acoustic analysis

VOT is considered to be a continuous variable that is context dependent. With this type of data, the use of spectrographic analyses is important in order to record numeric data (Thomas, 2002). The acoustic analysis in the present study was carried out using *Praat* (Boersma & Weenink, 2012), a free software program for analyzing speech sounds. All words in a 10-minute segment containing a voiceless dental were extracted from the interviews conducted with monolinguals and bilinguals of Spanish and CE. Tokens were extracted anywhere after the 10th

minute of the interview.[5] The total number of tokens extracted from the 10-minute segments of all 15 participants is 2,128. There were three positions relevant to this analysis in which /t/ could have appeared: absolute word initial, prevocalic (#__V); postconsonantal, prevocalic (C__V); and intervocalic (V__V). In the case that a word contained more than one /t/ (e.g., ToTalmenTe 'totally'), all instances of the /t/ were analyzed.

The acoustic measurements of the voiceless dentals were then performed keeping in mind the three stages of consonant stops to be able to pinpoint them on a spectrogram and waveform (see Docherty (1992) and Ladefoged (2003)). The VOT interval was highlighted from the burst release to the onset of the following vowel. Praat provided the measurement of the interval in seconds, which was later converted to milliseconds. In the case that the characteristics are not easily detected in the spectrogram due to background noise, that particular /t/ was excluded from the analysis.

6.6 Linguistic Factors

Table 2. Linguistic factors coded

Factor groups
Preceding segment
zero (e.g. *…grater some coconut and boil, take the oil out and give…* [PART 004])
voiceless fricative (e.g. *…help her kids in the studies*. [PART 009]; *but we had access to medical…* [PART 001])
vowel (e.g. *…deserve to go to the doctor…* [PART 002]; *I'm a latina*. [PART 007])
other consonants (e.g. *He's seventeen, i think, sixteen*. [PART 002])
Following vowel
Position in word
word-initial (e.g. *tea* [PART 001]) vs. word-internal (e.g. *sometime* [PART 009])
Syllable stress
tonic (e.g. '*talking* [PART 007]) vs. atonic (e.g. '*certain* [PART 004])
Rate of speech (syllables per second)
Lexical item
Word class
Word frequency
of each word out of the total number of words in the corpora (Spanish: 13,681; English: 22,050), and normalized by per 10,000 words

After the acoustic analyses, each occurrence of the voiceless dental was coded for the following linguistic factors: preceding segment, position of /t/ in the word, following vowel, syllable stress, rate of speech[6], lexical type, word class, and word frequency. These factors were chosen due to their importance on the variability of VOT duration analyzed in previous studies concerned with monolingual speakers of Spanish and English, and bilingual speakers of these

[5] Each interview varied according to the context in which it was carried out. Therefore, it was not possible to always begin and end the token extraction at the same minute for all participants, as they spoke Spanish and Creole English at different times. Also, tokens were not extracted where other-language material was present in order to avoid effects of codeswitching.

[6] Rate of speech was calculated by dividing word duration (in msec.) by the amount of syllables in the word.

languages (see Section 5.1). Another source for some of these linguistic constraints was literature dealing with usage-based models of language and phonology. Said models are concerned with the role that frequency has on the development and organization of linguistic structures (see Bybee, 2000; Pierrehumbert, 2001). Place of articulation was not included as a factor since the sound being analyzed will always be dental. Additionally, age of acquisition was not included, especially for the case of bilinguals, because all of the participants are generally from the same age group and acquired Spanish and CE at the same age. However, it is still important to keep in mind that they are early bilinguals, and thus, should allow us to determine if early bilinguals do indeed maintain separate phonetic systems as is hypothesized in the SLM.

6.6 Statistical Analysis

Subsequently, the data was submitted to a variable rule analysis in order to statistically pinpoint the effect of the conditioning factors on VOT duration. This multiple regression procedure determines which factors contribute statistically to the choice of one form over another (Poplack & Tagliamonte, 2001:92) when they are included in a single model. Rbrul (Johnson, 2009) was selected for the statistical analysis in the present study as it makes it possible to examine numeric data such as VOT using linear regressions with mixed effects. The program estimates the effects of factors on mean values (Johnson, 2009).

The linear regressions report results in coefficients. A coefficient of 0 is considered a neutral effect (i.e., no effect in either direction), while a positive coefficient shows a favoring effect, and a negative one, a disfavoring effect. In the case of VOT duration, the positive coefficient tells us that a particular factor favors an increase in the mean, and the negative coefficient tells us that a factor favors a decrease in the mean. In this study, the order of coefficients is taken to be the constraint hierarchy, that is, the order of effect of the conditioning factors that contribute to mean VOT duration. This factor ranking, along with the statistical significance of the factor groups, was considered to be the underlying system of the language in terms of this acoustic property[7] (see Poplack & Tagliamonte, 2001; Poplack & Levey, 2010). According to Poplack and Meechan (1998:13), the factor rankings are language-specific, and thus, can be used as diagnostics of language membership. When the factor groups were not determined to be significant, the rankings were taken as tendencies of the language. Once the results were organized for each group, comparisons of the constraint hierarchies across the four varieties were performed. Section 6.7 explains the method of comparison.

6.7 Comparative Variationist Method

The primary goals of the application of the comparative variationist method in a language contact study are: 1) to determine whether change is occurring in a bilingual speech community, and 2) to ascertain the putative source of the change (Poplack & Levey, 2010). These goals are accomplished through a series of comparisons of factor effect rankings between non-contact and contact varieties. Therefore, in the present analysis, I took the results of the variable rule analyses for each variety and compared them side-by-side. If a contact variety (e.g., bilingual Spanish) showed the same order of effect of conditioning factors as its non-contact counterpart (e.g.,

[7] The statistical modeling in the comparative variationist method also includes statistical significance and relative strength of factor groups as diagnostics for language change. For some researchers (e.g., Meyerhoff, 2009), the relative strength, also know as magnitude of effect, indicate strong transfer from the model language to the replica language; however, others (e.g., Poplack & Tagliamonte, 2001) state that the constraint hierarchy gives a more refine view of the grammar underlying surface manifestations.

monolingual Spanish), and not that of the source variety (e.g., monolingual CE), it was determined that no change had occurred in the Spanish production of bilinguals. If a contact variety did not show the same order of effect of conditioning factors of either of the other varieties, then it was determined that an internal change had occurred in this variety. If a contact variety did not feature the same order of effect as the monolingual counterpart, but did have the same order as the source variety, then it was determined that a contact-induced change had occurred in the bilingual variety. It is important to note that language change can be determined by employing two different methods, apparent time or real time. Apparent time studies compare the patterns of variation across age levels in a speech community (Labov, 1994:46), whereas real time studies compare data from different points in time (Labov, 1994:73). Apparent time studies reveal a recent synchronic change, while real time studies reveal a diachronic change. The present study deals mainly with a possible diachronic change that has taken place[8]; however, since there is no earlier data available from the bilingual speech community, the monolingual varieties of Spanish and CE are used to represent an earlier stage of these languages spoken in Panama before bilingualism ensued.

Another important comparison in this study is between contact varieties. This comparison allows us to explore whether bilinguals have a merged phonetic system or two separate systems for each language with regard to VOT duration. If the bilingual varieties shared the same order of effect, it was determined that bilinguals had a merged phonetic system. However, if the order of effect was different for each variety, it was determined that bilinguals had two separate phonetic systems for Spanish and CE. The results of these comparisons are discussed in Section 7.

7. Results and Discussion

Traditionally, literature that has analyzed the effect of certain factors on VOT values has presented means and has used t-tests in order to show significant results (e.g., Schmidt & Flege (1996)). The data analyzed are usually collected in a laboratory where participants read a list of words containing the target sound. As mentioned, the present study offers a variationist account of the voiceless dental when it is produced in naturally occurring speech. Following the standard methods used in variationist work (see Section 6), a linear regression model with mixed effects is incorporated in order to determine which factors when included in a single model significantly affect mean VOTs. These results, which consist of statistical significance and constraint hierarchies of the conditioning factors, are considered to be the underlying system of VOT duration of the voiceless dental plosive. In what follows, I present the mean VOT values for the four varieties (Section 7.1) and the comparison of the constraint hierarchies for each variety to determine whether change has occurred in this speech community and the source of the change (Section 7.2).

7.1 Distribution of Mean VOT Duration

Tables 3 and 4 present the comparisons of the overall mean VOT duration of /t/ among all four varieties, which addresses Research Question 1 (Section 6.3) and Hypothesis 1 (Section 6.4). It can be seen that the mean VOT value for the voiceless dental in monolingual Spanish is

[8] Although the current focus is a possible diachronic change, I do not discard that there could be ongoing change occurring in the speech of bilingual West Indians today. This idea of ongoing change is further discussed in Section 7.3 in the context of possible emerging ethnic varieties in Panama.

15.24 msec. This length is greater than that of the voiceless dental in Puerto Rican Spanish analyzed in Lisker and Abramson (1964) and in Argentine Spanish analyzed in Borzone de Manrique (1980). The mean VOT values for these varieties were 9 msec. and 15 msec., respectively. Conversely, the mean VOT of the voiceless dental in the present study is shorter when compared to Valdivian Spanish (16.4 msec.), Canarian Spanish (16.6 msec.), and Castilian Spanish (19.75 msec.) (Roldan & Soto Barba, 1997; Deniz, 2005). In the monolingual CE variety, the mean VOT for the voiceless dental is 28.43 msec, which is much smaller than the mean VOT observed in American English analyzed in Lisker & Abramson (1964), which was 70 msec. The voiceless dental in bilingual Spanish exhibits a mean VOT of 21.15 msec. Lastly, in the bilingual CE variety, 34.20 msec. is the mean VOT for the voiceless dental.

Table 3. Mean VOT, standard deviation, and range for the monolingual and bilingual varieties

Group	Mean VOT (/t/) in msec.	Standard deviation	Range
Monolingual Spanish	15.24	7.58	0-52
Monolingual Creole English	28.43	13.48	0-82
Bilingual Spanish	21.15	8.95	2-87
Bilingual Creole English	34.20	18.33	0-168

Table 4. Comparison of mean VOT values in monolingual and bilingual varieties

	Spanish	Creole English	*Significance*
Monolingual	15.24	28.43	p<2.2e-16 (R=52090)
Bilingual	21.15	34.20	p<2.2e-16 (R=66233.5)
Significance	p<2.2e-16 (R=73672)	p=2.246e-08 (R=121398.5)	

These results confirm the hypothesis that monolingual Spanish speakers would have the shortest VOT duration for the voiceless dental plosive. Also, we see that monolingual speakers of CE produce this sound with a longer mean VOT than that of the monolingual speakers of Spanish.

For bilinguals, we notice that their Spanish VOT value falls between the monolingual values, and their CE value is greater than that of the monolingual CE speakers. These findings confirm Flege's dissimilation hypothesis, which is in line with the Speech Learning Model. We see that bilinguals have compromise VOT values in Spanish, but their values in CE exceed those of monolingual CE speakers. Thus, bilinguals seem to show dissimilation in their phonetic system based soley on mean VOT values. Recall that the bilingual participants included in this analysis claimed to have learned CE in the home and Spanish by the age of 5; therefore, we can consider them to be early bilinguals. According to Flege (1987) and Flege (1995b), these bilinguals would have two systems because by the time they began to learn the L2, their L1 had not been fully developed already; therefore the process of equivalence classification did not block the development of the L2 phone, but rather aided in establishing it independently of the L1. This would explain why these bilinguals exhibit a different value for each language. I take up this topic once again in Section 7.2.3 when I discuss the constraint hierarchies of the bilingual varieties. In the ensuing section, I examine how the bilinguals compare to the monolinguals with regard to the factors included in the multivariate analyses.

7.2 Modeling Sound Change in Bilingual West Indian Speech

This section is concerned with modeling sound change in bilingual speech, utilizing the comparative variationist method established by Poplack and Tagliamonte (2001) in their work on African American English in the diaspora. This method has also been used in studies concerning language contact (e.g., Torres Cacoullos & Aaron, 2003; Blondeau & Nagy, 2008; Poplack & Levey, 2010). In the present study, I analyze the speech of bilinguals and compare it to that of monolinguals to discover evidence of sound change, and its possible source, based on the criteria discussed in Section 6.7. In what follows, I present the results of the comparisons of the underlying patterns of VOT duration of the voiceless dental in the four language varieties. In Section 7.2.1, I discuss how bilingual Spanish compares to the monolingual varieties of Spanish and CE. Later, in Section 7.2.2, I focus on the comparison of bilingual CE to the same monolingual varieties. Lastly, in Section 7.2.3, I compare bilingual Spanish to bilingual CE to find evidence of possible convergence or divergence in bilingual speech. The results address Research Question 2 (Section 6.3) and Hypothesis 2 (Section 6.4) of the analysis, that is, do bilinguals exhibit change, and if so, is this change contact-induced or internally motivated.

7.2.1 Bilingual Spanish Compared to Monolingual Spanish and Monolingual Creole English

Tables 5 - 8 compare bilingual Spanish with monolingual Spanish (the monolingual counterpart) and with monolingual CE (the source variety), where both internally motivated change and contact induced change are apparent. Internally motivated change is noted in word class (Table 5), in which bilingual Spanish does not line up with its monolingual counterpart or with the source variety. The change in constraint hierarchy is indicated by arrows pointing up or down. In bilingual Spanish, VOT duration tends to be longer in pronouns than in prepositions or verbs, whereas in monolingual Spanish, VOT duration is longer in prepositions than in verbs, adverbs, or pronouns. When compared to monolingual CE, we observe that bilingual Spanish VOT duration is longer in adjectives than in adverbs or nouns, but in monolingual CE, VOT duration is longer in adverbs and nouns than in adjectives. It is important to note that word class is not significant in either of the language modes. Since bilingual Spanish shows a change in constraint rankings when compared to both the monolingual counterpart and the source variety, this is evidence of internal change in Spanish spoken by bilinguals.

Table 5. Monolingual varieties vs. Bilingual Spanish: internally motivated change in word class

Monolingual Spanish			Bilingual Spanish			
	Coef	N		Coef		N
Preposition	*[1.174]	5	Preposition	[1.475]	▼	11
Verb	[0.374]	172	Verb	[0.842]	▼	147
Adverb	[0.255]	53	Adverb	[-3.326]	▼	85
Pronoun	[0.154]	40	Pronoun	[3.563]	▲	39
Noun	[-0.086]	126	Noun	[-1.510]		158
Adjective	[-1.870]	103	Adjective	[-1.044]	▲	88
Monolingual Creole English						
Pronoun	[5.588]	45	Pronoun	[3.563]		39
Preposition	[0.414]	48	Preposition	[1.475]		11
Adverb	[-0.281]	56	Adverb	[-3.326]	▼	85
Noun	[-0.666]	178	Noun	[-1.510]	▼	158
Verb	[-1.129]	93	Verb	[0.842]	▲	147
Adjective	[-3.817]	58	Adjective	[-1.044]	▲	88

*Coefficients in brackets indicate that the factor group was not selected as significant in the multivariate analysis.

Table 6. Monolingual varieties vs. Bilingual Spanish: contact induced change in preceding segment

Monolingual Spanish			Bilingual Spanish			
	Coef	N		Coef		N
Zero	1.058	36	Zero	[0.855]		27
Voiceless fricative	0.819	73	Voiceless fricative	*[-0.772]	▼	57
Consonant	-0.762	169	Consonant	[0.116]	▲	200
Vowel	-1.115	221	Vowel	[-0.199]	▲	244
Monolingual Creole English						
Zero	1.527	8	Zero	[0.855]		27
Consonant	1.286	223	Consonant	[0.116]		200
Vowel	0.491	199	Vowel	[-0.199]		244
Voiceless fricative	-3.304	158	Voiceless fricative	[-0.772]		57

Table 7. Monolingual varieties vs. Bilingual Spanish: contact induced change in position

Monolingual Spanish			Bilingual Spanish			
	Coef	N		Coef		N
Word internal	[0.356]	321	Word internal	[-0.06]		219
Word initial	[-0.356]	178	Word initial	[0.06]	▲	309
Monolingual Creole English						
Word initial	[2.001]	329	Word initial	[0.06]		219
Word internal	[-2.001]	259	Word internal	[-0.06]		309

Table 8. Monolingual varieties vs. Bilingual Spanish: contact-induced change in rate of speech

Monolingual Spanish			Bilingual Spanish		
	Coef	N		Coef	N
+1	[-0.112]	--	+1	-0.372	--
Monolingual Creole English					
+1	**-1.013**	--	+1	**-0.372**	--

Contact-induced change is noticed in preceding segment (Table 6), position (Table 7), and rate of speech (Table 8); that is, bilingual Spanish is similar to the source variety and not its monolingual counterpart in terms of these factors. The preceding segment constraint hierarchy of bilingual Spanish parallels to that of monolingual CE and not to that of monolingual Spanish. We notice that voiceless fricatives favor a longer VOT duration as opposed to other consonants and vowels in monolingual Spanish, however, in the bilingual variety, VOT duration tends to be shorter with voiceless fricatives and longer with other consonants and vowels. This order, zero > consonant > vowel > voiceless fricative, is also exhibited in monolingual CE.

With regard to position, bilingual Spanish shares the same constraint hierarchy with monolingual CE. VOT duration is longer when the voiceless dental is in word initial position, and shorter in word internal position. In monolingual Spanish, the order is reversed. I should note that preceding segment is not significant in bilingual Spanish, and that position is not significant in any of the varieties.

In terms of rate of speech, monolingual CE and bilingual Spanish share this factor as significant, and it has the same direction of effect; as rate of speech increases, a shorter VOT duration is favored. In monolingual Spanish, rate of speech is not a significant factor, however, it does have the same direction of effect. Due to the fact that bilingual Spanish resembles the source variety and not its monolingual counterpart in terms of preceding segment, position, and rate of speech, it can be concluded that contact-induced change has occurred in the Spanish variety spoken by bilinguals. In Section 7.2.2, I compare bilingual CE to the monolingual varieties.

7.2.2 Bilingual Creole English Compared to Monolingual Spanish and Monolingual Creole English

Tables 9 - 11 present the comparisons between bilingual CE and the monolingual varieties, where internally motivated change is apparent, and there is no evidence of contact-induced change. That is, bilingual CE only exhibits change where it does not parallel its monolingual counterpart or the source variety.

Table 9. Monolingual varieties vs. Bilingual Creole English: internally motivated change in vowel height

Monolingual Creole English			Bilingual Creole English		
	Coef	N		Coef	N
i	7.430	46	i	[7.991]	31
u	6.124	185	u	[0.646]	157
o	-2.071	38	o	[-3.163]	▼21
e	-3.772	177	e	[-2.198]	172
a	-7.711	142	a	[-3.277]	132
Monolingual Spanish					
i	2.958	61	i	[7.991]	31
u	1.104	44	u	[0.646]	157
o	-0.164	114	o	[-3.163]	▼ 21
e	-0.846	118	e	[-2.198]	172
a	-3.052	162	a	[-3.277]	132

Table 10. Monolingual varieties vs. Bilingual Creole English: internally motivated change in word class

Monolingual Creole English			Bilingual Creole English		
	Coef	N		Coef	N
Pronoun	[5.588]	45	Pronoun	[-2.079]	▼17
Preposition	[0.414]	48	Preposition	[0.906]	63
Infinitival marker	[-0.110]	110	Infinitival marker	[-0.312]	74
Adverb	[-0.281]	56	Adverb	[-2.585]	▼34
Noun	[-0.666]	178	Noun	[-2.720]	▼156
Verb	[-1.129]	93	Verb	[-1.156]	▲112
Adjective	[-3.817]	58	Adjective	[7.947]	▲57
Monolingual Spanish					
Preposition	*[1.174]	5	Preposition	[0.906]	▼ 63
Verb	[0.374]	172	Verb	[-1.156]	▼ 17
Adverb	[0.255]	53	Adverb	[-2.585]	▼ 112
Pronoun	[0.154]	40	Pronoun	[-2.079]	34
Noun	[-0.086]	126	Noun	[-2.720]	▼ 156
Adjective	[-1.870]	103	Adjective	[7.947]	▲ 57

Table 11. Monolingual varieties vs. Bilingual Creole English: internally motivated change in frequency

Monolingual Creole English		Bilingual Creole English	
	Coef		Coef
+1	[-0.032]	+1	**[0.003]**
Monolingual Spanish			
+1	[-0.037]	+1	**[0.003]**

Internally motivated change is noticed in vowel height (Table 9), word class (Table 10), and word frequency (Table 11). Although the expected effect was found for vowel height in bilingual CE, that is, VOT duration tends to be longer with high vowels, and shorter with low and mid vowels, the constraint hierarchy differs from both monolingual varieties. VOT duration is longer with /o/ than with /e/, whereas in the monolingual varieties, /e/ favors a longer VOT duration than /o/.

Following vowel height is not significant in the bilingual variety of CE as opposed to monolingual CE and Spanish, thus further demonstrating an internal change because it does not look like any of the languages. In terms of word class, bilingual CE does not line up with either monolingual variety. When compared to monolingual CE, we notice that the only similarity in ranking is found with preposition and infinitival marker. When compared to monolingual Spanish, the hierarchies coincide only with pronouns. Word class did not achieve significance in any of the varieties.

Turning to the effect of word frequency, we observe that bilingual CE differs from both monolingual varieties in that as frequency increases, VOT duration becomes longer; whereas in monolingual CE and Spanish, VOT duration becomes shorter as frequency increases. This factor also did not achieve significance in any of the varieties.

As I mentioned above, there is no evidence of contact-induced change. Bilingual CE does not parallel monolingual Spanish in any of the factors, except for rate of speech. However, monolingual CE also has the same effect of rate of speech, thereby demonstrating that the similarity found between bilingual CE and monolingual Spanish is not due to contact.

7.2.3 Bilingual Spanish compared to Bilingual Creole English

The comparison between bilingual varieties is performed to determine whether bilinguals have two separate phonetic systems or one merged system (see Section 3). As I discussed in Section 7.1, following the SLM, it appears that, based on solely mean values, the Spanish-Creole English bilinguals have a separate phonetic system for each language and that these speakers have moved away from monolingual norms. However, it is generally accepted that language change is gradual; usage-based models of language claim that change occurs in certain dimensions of the languages before others (Bybee, 2001). Therefore, a claim that change has taken place based on mean values must be regarded with suspicion. Likewise, the idea that the two languages of bilinguals have completely separate systems is also dubious. Considering these suspicions, the question should be to what extent bilingual Spanish differs from bilingual CE, and whether the line is clean cut. A variationist model elucidates the situation when we compare the underlying patterns of the factors that condition VOT duration in bilingual Spanish and bilingual CE.

Table 12 presents the comparison of the underlying systems of bilingual Spanish and bilingual CE. This comparison should uncover the similarities and the differences between the phonetic systems of the two languages spoken by a bilingual group. Generally, the results show that the constraints in each language are indeed different, thus, demonstrating two phonetic systems. However, the comparison also reveals evidence of convergence.

Although we notice that bilingual Spanish and bilingual CE differ in the factors selected as significant in the linear regression analysis (in the former, vowel height; in the latter, word position), there is also one that is shared: rate of speech. Moreover, the direction of effect is the same in this factor: as rate of speech increases by one unit, VOT values increase. Thus, we have

the first piece of evidence demonstrating that the two phonetic systems are not completely separate, in spite of preliminary conclusions we may like to draw based on mean values alone.

Table 12. Comparison between bilingual varieties

Bilingual Spanish			Bilingual Creole English		
Factor	Coef	N	Factor	Coef	N
Vowel			Vowel		
i	4.527	75	i	[7.991]	31
u	1.257	48	u	[0.646]	157
o	-1.119	91	o	[-3.163]	▼21
e	-1.824	151	e	[-2.198]	172
a	-2.841	163	a	[-3.277]	132
Rate of speech			Rate of speech		
+1	-0.372	--	+1	-1.56	--
Word class			Word class		
Pronoun	[3.563]	39	Pronoun	[-2.079]	▼17
Preposition	[1.475]	11	Preposition	[0.906]	63
Verb	[0.842]	147	Verb	[-1.156]	112
Adjective	[-1.044]	88	Adjective	[7.947]	▲57
Noun	[-1.510]	158	Noun	[-2.720]	▼156
Adverb	[-3.326]	85	Adverb	[-2.585]	▲34
Preceding segment			Preceding segment		
Zero	[0.855]	27	Zero	[1.642]	10
Consonant	[0.116]	200	Consonant	[0.547]	206
Vowel	[-0.199]	244	Vowel	[0.383]	153
Voiceless fricative	[-0.772]	57	Voiceless fricative	[-2.572]	144
Position			Position		
Word initial	[0.06]	219	Word initial	6.25	210
Word internal	[-0.06]	309	Word internal	-6.25	303
Stress			Stress		
No	[0.527]	320	No	[-2.223]	293
Yes	[-0.527]	208	Yes	[2.223]	▲220
Frequency			Frequency		
+1	[-0.018]	--	+1	[0.003]	--

Another piece of evidence of convergence between bilingual Spanish and bilingual CE is found in preceding segment, where the tendency is the same: zero > consonant > vowel > voiceless fricative. It is also important to note that monolingual CE exhibits the same constraint hierarchy, and monolingual Spanish does not (see Table 6); therefore, the convergence indicates

that bilingual speakers are moving towards monolingual CE norms. Convergence is further supported in terms of this factor group due to the fact that preceding segment is not significant in the bilingual varieties but is in the monolingual ones.

A final piece of evidence of convergence is found in word position, where VOT values tend to be greater in word initial position and shorter in word internal in bilingual Spanish and bilingual CE. I should note here that monolingual CE shares the same tendency, and monolingual Spanish does not (see Table 7). Therefore, the convergence shows that bilinguals are leaning towards monolingual CE norms, as was seen for preceding segment; however, bilingual CE is the only variety to have word position as a significant factor.

I have demonstrated in these sections how the comparative variationist method can aid in pinpointing areas of linguistic change and ascertaining its source in a contact situation. I also showed how this method can be used to determine whether bilinguals exhibit a merged phonetic system or if they have two separate systems in their linguistic repertoire. In the ensuing sections, I explore the possible reasons for change in this bilingual community, and what it could mean for West Indians living in Panama. I also explain the implications of this type of analysis on the SLM.

7.3 Emerging Antillano Spanish and Antillano English

I posited that bilinguals would follow monolingual Spanish norms in both Spanish and CE. That is, I expected bilinguals to show contact-induced change when producing CE, and to have patterns similar to those of monolingual Spanish speakers when producing Spanish. This hypothesis was based on the fact that the West Indian community has been present in Panama since the early 1800s, and it is smaller in size compared to the monolingual Mestizo community. Also, historically, West Indians have not been as socioeconomically successful as Mestizos. It is also important to note that Spanish is the dominant language in this region; thus, I expected there to be evidence of language shift towards Spanish. These factors are part of a general predictor for contact-induced change, i.e., intensity of contact, as discussed in Thomason (2001).

The findings of the analysis seem to confirm the hypothesis and suggest that the West Indian speech community could be in the initial stages of having new emerging varieties, which I will call Antillano Spanish (AS) and Antillano English (AE)[9]. Although not certain, the apparent emergence of these varieties is based on internally motivated and contact-induced changes occurring in this speech community. Additionally, convergence in bilingual speech suggests that bilingual West Indians are moving towards monolingual CE speaker norms. When Antillano Spanish (=bilingual Spanish) was compared to the monolingual varieties, internal change was observed only in word class, and contact-induced change was seen in preceding segment, position, and rate of speech. When comparing Antillano English (=bilingual CE) to the monolingual varieties, internally motivated change was noticed in vowel height, word class, and word frequency. Contrary to the hypothesis, there was no evidence of contact-induced change when bilinguals spoke Antillano English; there does not seem to be any evidence of language shift towards Spanish among the participants of this study.

[9] The term "antillano", which can be translated to "Antillean", is used frequently in Panama to refer to people of West Indian descent. I chose to use this term specifically in Spanish because it represents a cultural identity that consists of West Indian, Mestizo, and even North American customs and traditions. The meaning of the word represents their West Indian identity, but the Spanish translation symbolizes the Panamanian influences in their daily lives.

When performing the intra-speaker comparison, that is, Antillano Spanish compared to Antillano English, the hypothesis was confirmed. I discovered that bilinguals maintain distinct phonetic systems for each language; however, there were signs of convergence. First, we saw that the languages are similar with regard to rate of speech. This factor was significant in both varieties and had the same direction of effect. Convergence was also evident in preceding segment in that this factor group was not significant in either language and the constraint hierarchy was the same. Finally, Antillano Spanish and Antillano English shared the same constraint hierarchy in word position, thus another sign of convergence. We see that in spite of what the merger hypothesis (see Flege (1987) and Flege (1995a)) predicts for early bilinguals, the participants in this analysis still approximate their languages in some areas. It appears that even though these bilinguals maintain distinct phonetic systems because they were able to establish Spanish phones independently of CE phones, as they become older, the process of equivalence classification begins to cause new exemplars from Spanish and CE to be identified as the same, thus convergence ensues. As bilinguals receive input from both monolingual and bilingual speakers, the new exemplars are strengthened, and therefore convergence spreads gradually throughout the systems. In this case, this has occurred in terms of rate of speech, preceding segment, and position. What I propose therefore, is a Variationist Speech Learning Model (VSLM) in which convergence is predicted also for early bilinguals, but that begins at a later age. This hypothesis allows for more variability of outcomes in the speech of early bilinguals, as some may not show convergence but others could. On one hand, convergence could occur if bilinguals tend to mix their languages in their daily lives or use either one in the same contexts. It could also occur as a way for them to act out their identity through their speech patterns. On the other hand, the absence of convergence could be explained if bilinguals tend to assign certain domains to their two languages, thus always keeping them separate. They could also be rejecting the norms of the dominant culture.

At first it seems that the VSLM does not account for the direction of convergence. It is possible that there can be convergence in which the language moves towards the norms of one of the systems. That is, Spanish-Creole English bilinguals could converge their languages and resemble Spanish, or they can converge and move towards CE. These types of convergence could be due to external factors.

It appears that we could incorporate the importance of external influences into the VSLM, which in this case is related to social factors. As noted in Section 7.2.3, the areas in which the Antillano varieties converged were where they became more similar to monolingual CE; therefore, with this convergence, we can ask the question of whether or not these bilinguals are establishing or acting out an Antillano identity in which they move towards monolingual CE norms. We could assume that this works as a mechanism to slow down possible language shift towards Spanish in these speakers (see Author (in press) for more discussion on these external factors).

8. Conclusions

Based on the analysis of linguistic factors, I have shown that some change has taken place in the West Indian speech community due to both internal processes and language contact. This analysis has shed light on the dynamic nature of languages in a contact situation. I have employed variationist methodology, specifically, the comparative variationist method, to analyze and explain certain linguistic outcomes among bilinguals in Panama. This study is the first to analyze voice onset time with this approach. Therefore, it not only contributes to the already

existent literature of language variation and change, Spanish dialectology, and creolistics, but it also explains the permeability of phonetic systems in a contact situation. Moreover, it adds to the debate on VOT duration among bilinguals and attempts to support the much discussed Speech Learning Model by proposing a model that is based on variation theory and methodology, a Variationist Speech Learning Model.

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